

## Article

# Adherence to the Mediterranean Diet and Its Association with Sustainable Eating Knowledge, Attitudes, Habits, and Cooking Self-Efficacy Among Spanish Adults: A Cross-Sectional Study

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## Abstract

This cross-sectional study examines adherence to the Mediterranean Diet (MD) lifestyle and its association with knowledge, attitudes, habits, and cooking self-efficacy related to healthy and sustainable diets among Spanish adults. Additionally, it explores how sociodemographic and behavioral variables influence adherence to the MD. An online survey was conducted with 380 participants, predominantly women, urban dwellers, and highly educated individuals. The results reveal limited knowledge about food sustainability, with only 58.1% recognizing the MD as a sustainable model. Multivariable logistic regression analyses showed that higher adherence to the MD lifestyle was significantly associated with older age. Younger individuals who cooked regularly reported higher cooking self-efficacy, which in turn was associated with living with children and with healthier and more sustainable dietary habits. These dietary habits were also linked to being female, highlighting the interconnected roles of gender, age, and domestic context in shaping attitudes toward healthy and sustainable eating. The findings highlight a strong interrelation among attitudes, habits, and cooking self-efficacy, which together influence MD adherence. These results underscore the importance of designing targeted public health interventions that enhance cooking self-efficacy as a key lever to promote healthier and more sustainable eating habits, particularly among men and individuals who cook infrequently.

**Keywords:** mediterranean diet; healthy diet; sustainable diet; dietary patterns; cooking self-efficacy; public health



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## 1. Introduction

The current global food system faces unprecedented challenges. Climate change, biodiversity loss, and the rise of non-communicable diseases are not isolated challenges

but interconnected drivers of a broader public, environmental, and political crisis. Together, they are exposing the fragility of current food systems and undermining their resilience, particularly in the face of global shocks [1]. The food system contributes approximately 30% of the emissions driving the climate crisis [2]. Given the central role of food, the transition to more sustainable diets emerges not only as a critical solution but also as a key catalyst for addressing this crisis. According to the Food and Agriculture Organization (FAO), sustainable diets are those that promote health and well-being, have low environmental impact, are culturally acceptable, and are economically accessible [3]. These diets are essential not only for preserving human health but also for ensuring the long-term sustainability of ecosystems and food systems. Among sustainable diets, the Mediterranean Diet (MD) is a traditional dietary pattern that stands out as a model that embodies the principles of sustainability, combining nutritional adequacy with environmental responsibility and cultural heritage [4,5].

The MD is characterized by a high intake of plant-based foods, such as fruits, vegetables, legumes, whole grains, nuts, and olive oil, along with moderate consumption of fish and dairy products and low consumption of red and processed meats. It also emphasizes seasonality, local sourcing, and conviviality, integrating food into a broader lifestyle that includes physical activity, rest, and social interaction [4,6]. This dietary pattern has been extensively studied and is associated with a wide range of health benefits. Meta-analyses and umbrella reviews have consistently linked MD adherence to reduced risks of cardiovascular disease [7,8], type 2 diabetes [9], metabolic syndrome [10], depression, and overall mortality [7–11]. Moreover, the MD has a lower environmental footprint compared to Western dietary patterns, particularly due to its reduced reliance on animal-based and ultra-processed foods [5]. As such, it aligns with several Sustainable Development Goals (SDGs), including those related to responsible consumption (SDG 12), climate action (SDG 13), and good health and well-being (SDG 3).

Despite its well-documented benefits, adherence to the MD is declining, even in countries where it has deep cultural roots. Spain, traditionally considered a stronghold of the MD, has experienced a significant erosion of this dietary pattern in recent decades [12]. The forces of urbanization, globalization, and the homogenization of food systems have contributed to a shift toward Westernized diets, characterized by high consumption of ultra-processed products, red meat, and sugary beverages [13]. These changes are not only detrimental to public health, contributing to rising rates of obesity and chronic disease, but also harmful to environmental sustainability, as they increase the demand for resource-intensive foods [14,15]. According to data from the ENRICA study (2008–2010) [16], only 12% of Spanish adults achieved high adherence to the MD, while 46% showed moderate adherence, highlighting an ongoing cultural and nutritional shift away.

This decline in MD adherence is considered systemic and multilayered and cannot be fully explained only by structural or economic factors, such as food affordability, availability, and marketing environments, even when they play a significant role. Dietary choices are influenced by a range of factors operating at different levels, based on the theoretical framework of the socio-ecological model [17]: structural (e.g., food environments, economic constraints), social (e.g., cultural norms, family dynamics), and individual (e.g., knowledge, motivation, time availability). Within the individual level, a range of psychological and behavioral factors have been identified as particularly influential, including nutritional knowledge, attitudes toward food, time constraints, cooking self-efficacy, and behavioral competencies [18]. Among these, the concept of cooking self-efficacy, defined as the perceived ability to prepare healthy and sustainable meals, has emerged as a key behavioral determinant, directly linked to healthier and more sustainable eating patterns [16,18,19]. Unlike cooking skills, which refer to technical proficiency, self-efficacy reflects one's confi-

dence and motivation and is strongly associated with the frequency of home cooking, the use of fresh ingredients, and overall diet quality [19–21]. In this regard, cooking self-efficacy may represent a promising intervention point. Rooted in Bandura’s Social Cognitive Theory [19], self-efficacy is considered a central construct for behavior change: individuals are more likely to adopt and maintain a behavior, such as cooking regularly, when they believe they are capable of doing so.

Furthermore, previous research has shown that individuals with higher cooking self-efficacy are more likely to consume fruits and vegetables, avoid ultra-processed foods, and adhere to dietary guidelines [20–24]. However, the role of cooking self-efficacy in promoting sustainable dietary patterns such as the MD remains underexplored.

In addition to cooking self-efficacy, limited knowledge about sustainable diets has also been identified as a key barrier to MD adherence. There seems to be a gap between awareness and actual dietary behavior that remains insufficiently addressed. One study found that a higher score in sustainable nutrition knowledge is associated with an increased MD adherence score [25]. However, a 2020 cross-sectional study among Spanish adults revealed widespread misconceptions about the environmental impact of food, with approximately 50% of participants believing that meat contributes positively to sustainability [26]. Similar knowledge gaps have been observed in other European countries, including Italy and Poland, where consumers often fail to associate sustainability with nutrition or underestimate the environmental costs of animal-based foods [27,28]. Even among health professionals in Spain, one-fifth reported never having heard the term “sustainable diet,” despite acknowledging its relevance in clinical practice [29]. In this context, another study conducted among dietitians in the United Arab Emirates found that they were more likely to recommend the MD if they had higher knowledge and attitude scores, were originally from a Mediterranean country, and had acquired information about the MD through university education or conferences, seminars, or workshops [30]. These findings point to a widespread lack of understanding among the general population about what constitutes a sustainable diet, despite the existence of clear scientific guidelines and consensus among health and nutrition professionals. This knowledge gap may be a key barrier to the adoption of more sustainable dietary behaviors.

Attitudes toward healthy and sustainable eating also play a key role in shaping food choices. In this context, attitudes refer to individuals’ beliefs, values, and emotional responses toward certain dietary practices. Positive attitudes, such as valuing local and seasonal foods, enjoying cooking, or perceiving sustainable eating as personally meaningful, can facilitate healthier food choices [31]. However, these attitudes are shaped as well by a complex interplay of factors at multiple levels of the socio-ecological model (individual psychological factors, interpersonal social influences, and broader cultural and environmental contexts) and may not always translate into action [17,32]. Barriers such as time constraints, social norms, cost perceptions, unhealthy food environments, and low cooking self-efficacy often prevent individuals from aligning their intentions with their behaviors [33–35]. Therefore, understanding how attitudes, knowledge, and behavioral competencies, particularly cooking self-efficacy, interact is essential for designing effective interventions to promote adherence to the MD.

This study aims to address these gaps by examining adherence to the MD lifestyle among Spanish adults and its association with knowledge, attitudes, and dietary habits related to healthy and sustainable eating and cooking self-efficacy. It also explores how demographic and socioeconomic variables influence adherence to this dietary pattern.

## 2. Materials and Methods

### 2.1. Subjects and Design

A cross-sectional online survey targeting Spanish adults was conducted between October and December 2024. The questionnaire was disseminated through multiple channels, including WhatsApp, email, Twitter, Instagram, and printed posters with QR codes, to maximize reach and diversity of respondents. Data collection was carried out using the Qualtrics platform, which ensured secure and anonymous participation. The study was approved by the Ethics Committee of the Universitat Oberta de Catalunya, under approval number CE22-TE39. Participation was voluntary, and informed consent was obtained prior to survey completion. The minimum required sample size was calculated using the standard formula for proportions in finite populations (95% confidence level, margin of error of  $\pm 5\%$ , and maximum uncertainty  $p = q = 0.5$ ), yielding a minimum of 384 participants. Recruitment followed a snowball sampling strategy through personal and professional networks. No economic compensation was offered, and the estimated time to complete the survey was 10–15 min. To ensure data quality, only fully completed questionnaires were considered, and responses with implausibly short response times or signs of inattentiveness (e.g., straightlining) were excluded through a posteriori screening. This approach ensured data completeness and minimized potential biases related to partial or low-quality responses. The online format and anonymous access were intended to mitigate social desirability bias.

### 2.2. Measures

The questionnaire used in this study was developed based on validated or evidence-supported instruments, in order to capture a comprehensive range of variables related to adherence to the MD lifestyle and its potential determinants. It included items assessing demographic and socioeconomic characteristics, knowledge of healthy and sustainable diets, attitudes toward sustainable eating, cooking self-efficacy, and dietary habits. All responses were self-reported. The questionnaire was originally developed and administered in Spanish. To enhance transparency and facilitate replication, the full questionnaire has been translated into English and is available in the Supplementary Material File S1. The English version is intended solely to facilitate comprehension by an international readership; all data were collected using the Spanish version. This allows readers to follow the distribution and positioning of items across sections. The three economic questions at the end of the original instrument were excluded from the Supplementary File S1, as they are not analyzed in this manuscript.

The demographic and socioeconomic section of the questionnaire included variables such as gender, age, country of birth, ethnicity [36], educational attainment, employment status, marital status, household composition (number of adults and children), municipality of residence, cooking habits (including whether participants usually cooked and for whom), and average monthly income. Age was recoded into 10-year intervals, with the youngest and oldest groups defined based on the observed minimum and maximum values. Residential areas were classified as rural or urban, using a threshold of 5000 inhabitants, a criterion that reflects the demographic structure of Spain, where small rural municipalities (under 5000 residents) represent over 78% of all municipalities and cover more than two-thirds of the national territory [37]. Subjective social status was assessed using the adult version of the MacArthur Scale of Subjective Social Status [38].

Adherence to the MD lifestyle was measured using the validated MEDLIFE 2.0 questionnaire [39], which consists of 29 items grouped into three thematic blocks: Mediterranean food consumption (items 1–14), Mediterranean dietary habits (items 15–21), and lifestyle-related behaviors such as physical activity, rest, and social interaction (items

22–29). Each item was scored dichotomously (0 or 1), yielding a total score ranging from 0 to 29, with higher scores indicating greater adherence to the MD lifestyle (see Supplementary Material Table S1d).

Attitudes toward healthy and sustainable diets were assessed using seven items (questions 1–3 and 13–16), while cooking self-efficacy was measured through nine items (questions 4–12). These items were adapted from evidence-supported scientific references [40–44], selected based on their alignment with the study’s conceptual framework and objectives. Internal consistency of both scales was assessed in the study sample using Cronbach’s alpha, yielding acceptable reliability for attitudes ( $\alpha = 0.707$ ) and excellent reliability for cooking self-efficacy ( $\alpha = 0.907$ ), thus supporting the internal validity of the constructs [45]. Responses were recorded on a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree.” Sustainable dietary habits were evaluated using six items adapted from the Sustainable Healthy Diet Index (SHED) [46], also rated on a 5-point Likert scale, where 1 corresponded to “never” and 5 to “always or almost always.” To ensure consistency across constructs, all Likert responses were recoded to a 0–4 scale, with original scores of 1 converted to 0 and scores of 5 converted to 4. This transformation allowed for a more accurate representation of the absence or presence of cooking self-efficacy, sustainable and healthy diet behaviors and attitudes and facilitated comparison across participants with varying levels of adherence, attitudes, dietary habits, and self-efficacy. Accordingly, the possible total scores for these three sections are 0–28 for attitudes, 0–36 for cooking self-efficacy, and 0–24 for sustainable dietary habits (see Supplementary Material Table S1a–c).

Definitions of the MD [4,6], sustainable diets (as defined by the FAO) [3,47], and healthy diets (as defined by the World Health Organization) [48] were clearly presented within the questionnaire and are available in Supplementary Material File S1. Participants could consult these definitions while responding. Rather than assuming prior understanding, the aim was to evaluate participants’ knowledge and perceptions regarding the relationship between health and sustainability and whether they considered the MD to be a sustainable dietary model. These items were adapted from Riddell et al. [49] and rated on a 5-point Likert scale. For analytical purposes, the first item was recoded into two categories based on current scientific consensus [50,51]. In our case, “strongly disagree,” “disagree,” and “strongly agree” were grouped into one category, while “neither agree nor disagree” and “agree” were grouped into a second category. This categorization was based on the scientific consensus that a healthy and a sustainable diet are not equivalent and allowed us to differentiate between participants with a clear position (regardless of accuracy) and those who were more uncertain or closer to the correct interpretation. Although this classification may appear counterintuitive, grouping “strongly agree” together with the disagreement options was intended to contrast respondents expressing a clear position (whether aligned or not with the consensus) against those with more ambiguous or partial agreement. The second item was recoded into three categories following the approach used by Biasini et al. [27]: “No” (disagree or strongly disagree), “not much/maybe” (neutral), and “yes” (agree or strongly agree). It should be noted that the criteria for the two items differed: for the first item, the aim was to distinguish between clear versus uncertain positions, while for the second the categorization reflected accuracy of the response. This distinction was intentional, given the different conceptual nature of the items.

To ensure the content validity of the instrument, the initial version of the questionnaire underwent a two-phase validation process. First, it was reviewed by a panel of eleven experts in nutrition, sustainability, and public health in the Mediterranean context. Each item was evaluated for its relevance to the study objectives, clarity of wording, and appropriateness for the target population. Experts rated each item on a 4-point scale, ranging from 0 (not understandable or not pertinent) to 3 (highly pertinent and easily understood).

Based on their feedback, the questionnaire was refined to improve conceptual alignment, linguistic precision, and coherence. In the second phase, a pilot test was conducted with ten Spanish adults to assess the clarity, usability, and technical functionality of the survey. Participants were asked to complete the questionnaire and provide qualitative feedback on any confusing or ambiguous items. The insights gathered from both the expert panel and the pilot participants were incorporated into the final version of the instrument. During the pilot testing phase, participants were explicitly asked to indicate any items they found unclear, either through written feedback or by contacting the research team via email. In addition, in the final version of the questionnaire, an open-text box was included at the end of the survey, allowing respondents to leave comments, suggestions, or request clarification if needed. These mechanisms ensured that participants had the opportunity to communicate any difficulties and that the research team could identify and address potential issues in a timely manner. A schematic overview of the questionnaire development, structure, and validation process is provided in Figure 1.

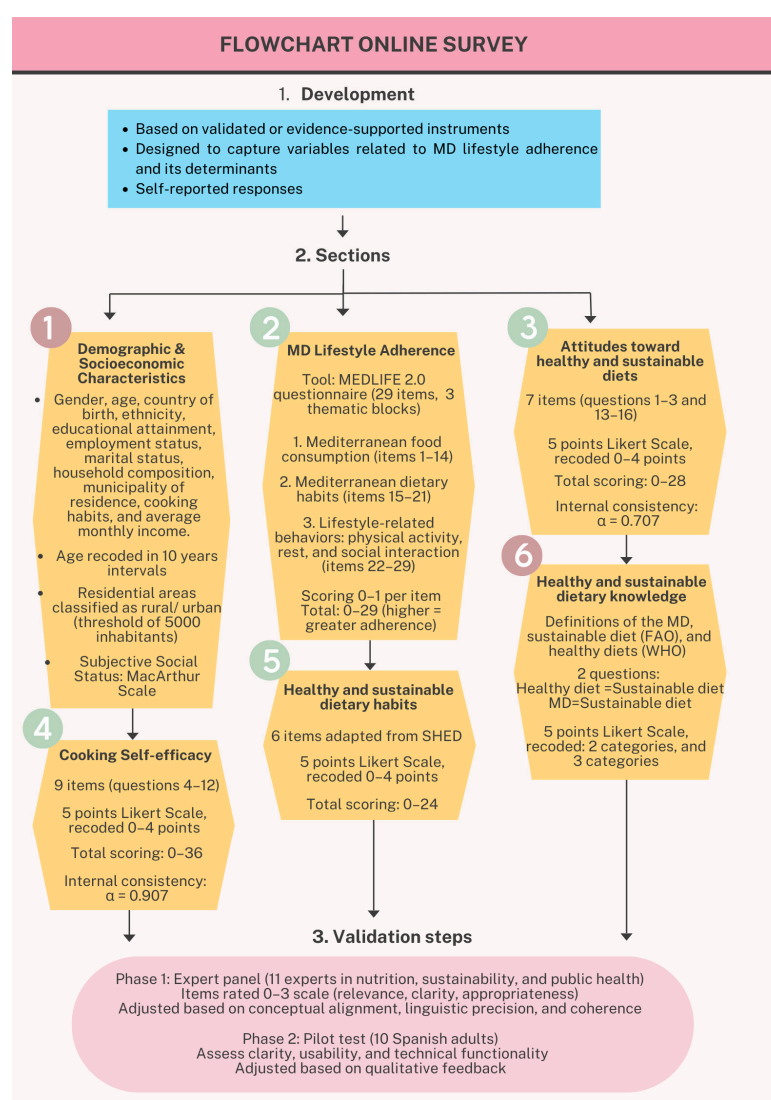


**Figure 1.** Flowchart of the online questionnaire. The figure summarizes the development process, the six sections of the questionnaire, and the validation steps. The numbers in teal indicate dependent variables, while the numbers in mauve indicate independent variables. Abbreviations: MD = Mediterranean Diet; MEDLIFE = Mediterranean Lifestyle Index; SHED = Sustainable Healthy Diet Index; FAO = Food and Agriculture Organization; WHO = World Health Organization.

### 2.3. Statistical Analysis

Descriptive and inferential analyses were conducted to evaluate the data. The Kolmogorov–Smirnov test rejected the assumption of normality ( $p < 0.05$ ). Continuous variables were expressed as means  $\pm$  standard deviations, while categorical variables were presented as frequencies and percentages. Data were summarized using medians and tertile ranges.

The main characteristics of the participants were described separately by gender. Potential associations between demographic and socioeconomic characteristics, adherence to the MD lifestyle, cooking self-efficacy, and healthy and sustainable dietary habits and attitudes were examined using the chi-square test ( $\chi^2$ ).

Adherence to the MD lifestyle, as well as cooking self-efficacy, and healthy and sustainable dietary habits and attitudes was determined by summing the item scores within each construct, following the recoding procedure described above, and then categorized into tertiles. For each tertile of the dependent variables, the distribution of each independent variable and of the remaining dependent variables was analyzed. Percentages were calculated for each tertile, and associations between variables were assessed using the chi-square test, except for age. As a continuous variable, age was analyzed using the Kruskal–Wallis test to assess its relationship with adherence to the MD lifestyle, cooking self-efficacy, and healthy and sustainable dietary habits and attitudes.

Additionally, multinomial logistic regression analyses were performed to identify characteristics that predict the third tertile of the adherence to the MD lifestyle, cooking self-efficacy, habits, and attitudes toward a healthy and sustainable diet while preserving the previously established tertile classification for the dependent variables. Prior to conducting the analyses, multicollinearity among the independent variables was assessed using tolerance and Variance Inflation Factor (VIF) statistics. All VIF values were below the commonly accepted threshold of 5, indicating no evidence of problematic multicollinearity in the model. First, univariate analyses were conducted for each variable independently. Variables with a  $p$ -value  $< 0.05$  in the univariate analysis, along with age, were included in a subsequent adjusted multivariate model.

A  $p$ -value of less than 0.05 was considered statistically significant. All statistical analyses were performed using USA: IBM SPSS Statistics for Windows, version 29.0 (Armonk, NY, USA: IBM Corp.).

## 3. Results

### 3.1. Sample Description

Although nearly 500 individuals initiated the questionnaire, the final analysis was conducted with 380 Spanish adults who provided valid and complete responses. The sample was predominantly female (75%) with a median age of 44 years. Most participants were born in Spain (97.1%), identified as having White/Mediterranean ancestry (93.2%), and lived in urban areas (96.3%). A significant proportion (74.8%) held higher education qualifications, including university degrees (41.1%) and advanced professional specializations such as master's degrees or equivalent (33.7%). More details about the study sample, analyzed by gender using the chi-square test, can be found in Table 1.

Attitudes toward healthy and sustainable diets showed a minimum of 4 points and a maximum of 28 points. Cooking self-efficacy had a minimum of 0 points (no self-efficacy) and a maximum of 36 points. Healthy and sustainable dietary habits yielded a minimum of 9 points and a maximum of 20 points. The last question from the dietary habits section was excluded from the tertile analysis due to a lack of significant association with the other variables, as determined by the chi-square test ( $p > 0.05$ ). To avoid potential bias in tertile

formation and to ensure robust results, this question was analyzed separately. The outcome is discussed in the following subsection.

**Table 1.** Sociodemographic characteristics, adherence to the MD lifestyle, attitudes toward healthy and sustainable diets, cooking self-efficacy, dietary habits, and knowledge, split by gender.

|                                                                                  | All (n, %)  | Female (n, %) | Male (n, %) | Others (n, %) | p Value |
|----------------------------------------------------------------------------------|-------------|---------------|-------------|---------------|---------|
| <b>Age range (years)</b>                                                         |             |               |             |               | 0.099   |
| 22–30                                                                            | 45 (11.8%)  | 33 (8.7%)     | 12 (3.2%)   | 0 (0%)        |         |
| 31–40                                                                            | 113 (29.7%) | 88 (23.2%)    | 22 (5.8%)   | 3 (0.8%)      |         |
| 41–50                                                                            | 74 (19.5%)  | 57 (15%)      | 15 (3.9%)   | 2 (0.5%)      |         |
| 51–60                                                                            | 80 (21.1%)  | 63 (16.6%)    | 16 (4.2%)   | 1 (0.3%)      |         |
| 61–70                                                                            | 61 (16.1%)  | 42 (11.1%)    | 19 (5%)     | 0 (0%)        |         |
| 71–84                                                                            | 7 (1.8%)    | 2 (0.7%)      | 5 (1.3%)    | 0 (0%)        |         |
| <b>Country of birth</b>                                                          |             |               |             |               | 0.006   |
| Spain                                                                            | 369 (97.1%) | 281 (73.9%)   | 82 (21.6%)  | 6 (1.6%)      |         |
| Others                                                                           | 11 (2.9%)   | 4 (1.1%)      | 7 (1.8%)    | 0 (0%)        |         |
| <b>Ancestry</b>                                                                  |             |               |             |               | 0.796   |
| White/Mediterranean                                                              | 354 (93.2%) | 265 (69.7%)   | 83 (21.8%)  | 6 (1.6%)      |         |
| Others                                                                           | 26 (6.8%)   | 20 (5.3%)     | 6 (1.6%)    | 0 (0%)        |         |
| <b>Education level</b>                                                           |             |               |             |               | 0.635   |
| Primary, secondary studies, or vocational training                               | 59 (15.5%)  | 43 (11.3%)    | 16 (4.2%)   | 0 (0%)        |         |
| University degree                                                                | 157 (41.3%) | 117 (30.8%)   | 38 (10%)    | 2 (0.5%)      |         |
| Master’s degrees, equivalent professional training (e.g., MIR, FIR, EIR), or PhD | 164 (43.2%) | 125 (32.9%)   | 35 (9.2%)   | 4 (1.1%)      |         |
| <b>Employment</b>                                                                |             |               |             |               | 0.143   |
| Full-time salaried                                                               | 240 (63.2%) | 176 (46.3%)   | 58 (15.3%)  | 6 (1.6%)      |         |
| Others                                                                           | 140 (36.8%) | 109 (28.7%)   | 31 (8.2%)   | 0 (0%)        |         |
| <b>Civil status</b>                                                              |             |               |             |               | 0.017   |
| Married                                                                          | 184 (48.4%) | 128 (33.7%)   | 55 (14.5%)  | 1 (0.3%)      |         |
| Single                                                                           | 147 (38.7%) | 116 (30.5%)   | 28 (7.4%)   | 3 (0.8%)      |         |
| Others                                                                           | 49 (12.9%)  | 41 (10.8%)    | 6 (1.6%)    | 2 (0.5%)      |         |
| <b>N. household members</b>                                                      |             |               |             |               | 0.042   |
| 1                                                                                | 64 (16.8%)  | 42 (11.1%)    | 18 (4.7%)   | 4 (1.1%)      |         |
| 2                                                                                | 222 (58.4%) | 170 (44.7%)   | 50 (13.2%)  | 2 (0.5%)      |         |
| 3                                                                                | 51 (13.4%)  | 41 (10.8%)    | 10 (2.6%)   | 0 (0%)        |         |
| >3                                                                               | 43 (11.3%)  | 32 (8.4%)     | 11 (2.9%)   | 0 (0%)        |         |
| <b>N. household members &lt; 18 years</b>                                        |             |               |             |               | 0.781   |
| None                                                                             | 272 (71.6%) | 202 (53.2%)   | 65 (17.1%)  | 5 (1.3%)      |         |
| 1                                                                                | 49 (12.9%)  | 37 (9.7%)     | 11 (2.9%)   | 1 (0.3%)      |         |
| 2                                                                                | 46 (12.1%)  | 34 (8.9%)     | 12 (3.2%)   | 0 (0%)        |         |
| ≥3                                                                               | 13 (3.4%)   | 12 (3.2%)     | 1 (0.3%)    | 0 (0%)        |         |
| <b>Area of residence</b>                                                         |             |               |             |               | 0.616   |
| Urban                                                                            | 366 (96.3%) | 273 (71.8%)   | 87 (22.9%)  | 6 (1.6%)      |         |
| Rural                                                                            | 14 (3.7%)   | 12 (3.2%)     | 2 (0.5%)    | 0 (0%)        |         |
| <b>Regularly cooking</b>                                                         |             |               |             |               | <0.001  |
| Yes                                                                              | 307 (80.8%) | 248 (65.3%)   | 54 (14.2%)  | 5 (1.3%)      |         |
| No                                                                               | 73 (19.2%)  | 37 (9.7%)     | 35 (9.2%)   | 1 (0.3%)      |         |

Table 1. Cont.

|                                                | All (n, %)  | Female (n, %) | Male (n, %) | Others (n, %) | p Value          |
|------------------------------------------------|-------------|---------------|-------------|---------------|------------------|
| <b>Net monthly income</b>                      |             |               |             |               | 0.124            |
| <1000€                                         | 23 (6.1%)   | 19 (5%)       | 4 (1.1%)    | 0 (0%)        |                  |
| 1000 to 2999€                                  | 288 (75.8%) | 217 (57.1%)   | 66 (17.4%)  | 5 (1.3%)      |                  |
| ≥3000€                                         | 41 (10.8%)  | 25 (6.6%)     | 16 (4.2%)   | 0 (0%)        |                  |
| Unknown                                        | 28 (7.4%)   | 24 (6.3%)     | 3 (0.8%)    | 1 (0.3%)      |                  |
| <b>Dependent variables (median value)</b>      |             |               |             |               |                  |
| Adherence to the MD lifestyle                  | 19          | 19            | 18          | 20            | <b>0.003</b>     |
| Attitudes toward healthy and sustainable diets | 21          | 21            | 19          | 21.5          | <b>&lt;0.001</b> |
| Healthy and sustainable cooking self-efficacy  | 31          | 32            | 27          | 27.5          | <b>&lt;0.001</b> |
| Healthy and sustainable dietary habits         | 16          | 16            | 15          | 15            | <b>&lt;0.001</b> |
| <b>Knowledge</b>                               |             |               |             |               |                  |
| <b>Healthy diet = Sustainable diet</b>         |             |               |             |               | 0.352            |
| Strongly disagree or agree/Disagree            | 220 (57.9%) | 159 (41.8%)   | 57 (15%)    | 4 (1.1%)      |                  |
| Neither agree nor disagree/Agree               | 160 (42.1%) | 126 (33.2%)   | 32 (8.4%)   | 2 (0.5%)      |                  |
| <b>MD = Sustainable diet</b>                   |             |               |             |               | 0.403            |
| No                                             | 83 (21.8%)  | 67 (17.6%)    | 15 (3.9%)   | 1 (0.3%)      |                  |
| Not much/maybe                                 | 76 (20%)    | 55 (14.5%)    | 21 (5.5%)   | 0 (0%)        |                  |
| Yes                                            | 221 (58.2%) | 163 (42.9%)   | 53 (13.9%)  | 5 (1.3%)      |                  |

MD = Mediterranean Diet; n/N = number of participants. Data for independent variables are expressed as absolute frequencies (n) and percentages (%), and were obtained through cross-tabulations. Data for dependent variables are expressed as medians, given that the sample did not follow a normal distribution. Statistical significance of associations between gender and categorical independent variables was assessed using the chi-square test ( $\chi^2$ ). For dependent variables, differences between gender groups were evaluated using the Kruskal–Wallis H test. A *p*-value < 0.05 was considered statistically significant. Values in bold indicate statistically significant results (*p* < 0.005).

As shown in Table 1, a substantial proportion of participants demonstrated limited understanding of what constitutes a sustainable diet, although more than half recognized the MD as a sustainable model. The association between these variables is illustrated in Supplementary Material Figure S1 (*p* < 0.001).

As shown in Figure 2, most participants reported enjoying cooking and trying new recipes, while fewer disagreed that cooking is too time-consuming or labor-intensive. Cooking self-efficacy decreased as task complexity increased, as illustrated in Figure 3, which shows the proportion of participants who reported feeling confident performing each specific cooking task.

In terms of healthy and sustainable dietary habits (see Supplementary Material Figure S2), 50.3% reported sometimes consuming frozen ready-to-eat meals weekly, while 63.2% primarily ate homemade/home-cooked meals, and 62.9% occasionally consumed refrigerated packaged ready-to-eat meals. Additionally, 80% occasionally ate outside the home, and 74.5% cooked or participated in meal preparation regularly. Slightly more than half (56.8%) reported weekly consumption of pre-prepared meals that had been cooked 1–3 days in advance.

The MEDLIFE questionnaire includes an item on wine consumption. In line with previous studies, we explored two scoring approaches: assigning 1 point for moderate wine consumption (1–2 glasses/day) and alternatively, assigning 1 point for abstinence. The latter approach, which favors abstinence from alcohol, was ultimately selected for analysis, as it was associated with higher overall adherence scores and aligned with recent evidence [52] suggesting health benefits of abstaining from alcohol. The minimum range was 7 points,

and the maximum was 26 points. All the participants of the study scored 55.8%, 82%, and 61.3% of the maximum points in the three sections of the MEDLIFE questionnaire.

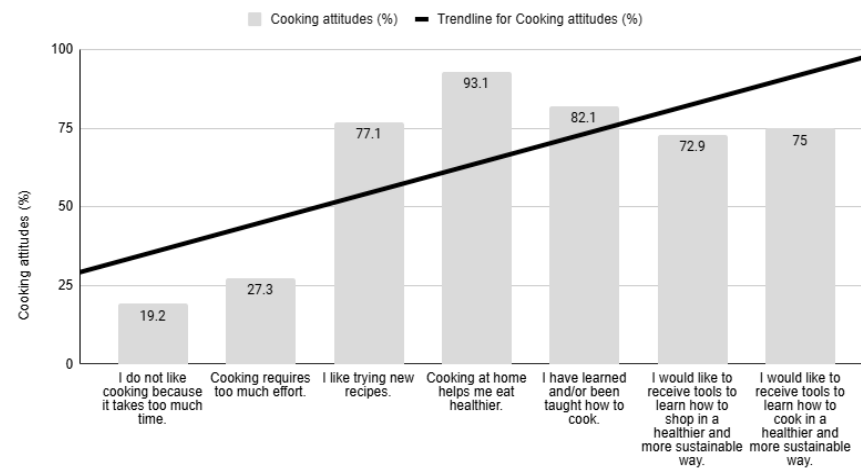


**Figure 2.** Percentage of Spanish adults ( $n = 380$ ) reporting attitudes toward healthy and sustainable diets. Percentages of respondents endorsing each statement were calculated by summing the responses in the categories *Agree* and *Strongly agree* of the Likert scale. Items are presented in their original thematic sequence, with the three learning-related items grouped at the end of the scale for clarity.

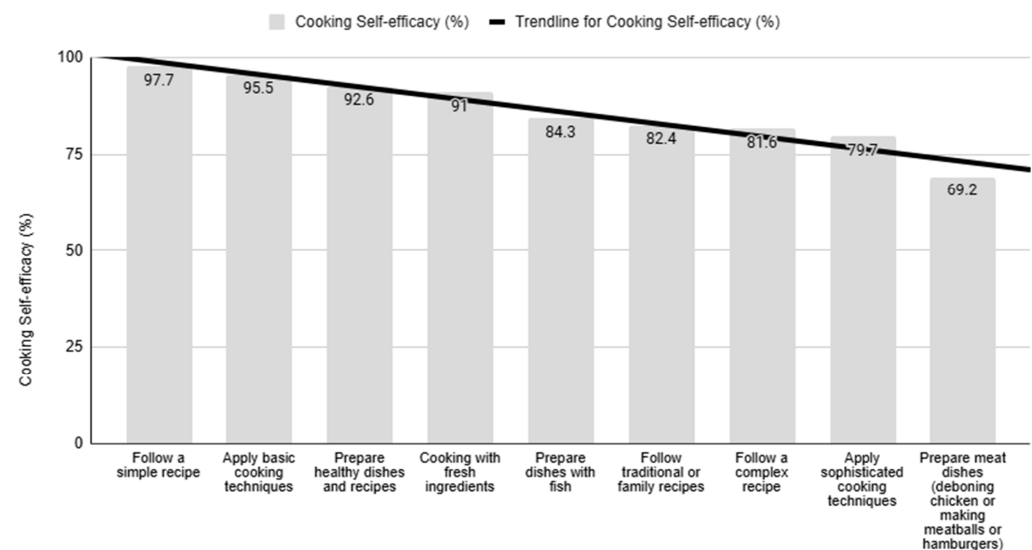


**Figure 3.** Percentage of Spanish adults ( $n = 380$ ) reporting cooking self-efficacy by task complexity. Percentages of respondents reporting self-efficacy were calculated considering the categories *Agree* and *Strongly agree* of the Likert scale.

### 3.2. Associations Between Variables

When MEDLIFE tertiles were compared, significant associations were observed with age, regular cooking, attitudes, and dietary habits ( $p < 0.05$ ). Older participants (48.7 [13.1]) and those who cooked regularly showed higher adherence to the MD lifestyle (see Supplementary Material Table S2). For attitudes toward healthy and sustainable diets, significant differences were found according to gender, age, regular cooking, dietary habits, and cooking self-efficacy ( $p < 0.05$ ) after comparing the tertiles of this section of the questionnaire. Cooking self-efficacy was likewise associated with gender, age, regular cooking, the number of children and/or adolescents (under 18 years old) living in the household, and dietary habits ( $p < 0.05$ ). In addition, healthy and sustainable di-

etary habits were significantly associated with gender and regular cooking ( $p < 0.05$ ) (see Supplementary Material Tables S3–S5).

Subsequently, the chi-square test was applied to variables from the SHED index individually, assessing their association with adherence to the MD lifestyle, attitudes and habits of a healthy and sustainable diet, and cooking self-efficacy. The results indicated that consuming frozen pre-cooked meals had a significant association with healthy and sustainable habits, as did consuming refrigerated pre-packaged meals ( $p < 0.001$ ). Eating homemade/home-cooked meals was significantly associated with adherence to the MD lifestyle ( $p < 0.001$ ), attitudes, and healthy and sustainable habits, as well as cooking self-efficacy ( $p = 0.005$  and  $p < 0.001$  for the latter two). Eating out was significantly associated with cooking self-efficacy and healthy and sustainable dietary habits ( $p < 0.001$ ). Participants who ate out more frequently showed lower cooking self-efficacy and poorer dietary habits. Lastly, preparing food for oneself or participating in food preparation showed significant associations with adherence to the MD lifestyle, attitudes, habits, and cooking self-efficacy ( $p < 0.001$ ). However, consuming meals cooked 1–3 days in advance did not show any significant associations among the participants. Further stratification by tertiles yielded no additional relevant insights and was therefore omitted from the analysis.

Multinomial logistic regression analyses revealed several significant associations in both univariate and multivariate analyses.

High adherence to the MD lifestyle was less common among men compared to women (OR = 0.365; 95% CI: 0.186–0.715;  $p = 0.003$ ). Participants aged 41–84 years were more likely to exhibit high adherence than those aged 22–40 years (OR = 2.22; 95% CI: 1.088–4.533;  $p = 0.028$ ). Not cooking regularly was associated with lower adherence (OR = 0.266; 95% CI: 0.122–0.581;  $p < 0.001$ ). Additionally, participants with less positive attitudes toward healthy and sustainable diets were less likely to have high adherence compared to those with medium positive attitudes (OR = 0.335; 95% CI: 0.175–0.644;  $p = 0.001$ ). Greater cooking self-efficacy and healthier and more sustainable dietary habits were also positively associated with adherence ( $p < 0.05$ ) (see Supplementary Material Table S6 for univariate model). In the multivariate analysis, age (OR = 3.094; 95% CI: 1.378–6.946;  $p = 0.006$ ) and healthy and sustainable dietary habits (OR = 0.26; 95% CI: 0.107–0.629;  $p = 0.003$ ) remained significant predictors (Table 2).

**Table 2.** Odds ratios for high adherence to MD lifestyle from Spanish adults, estimated using multinomial logistic regression in multivariate analysis.

|                          | Logistic Regression for High Adherence to MD Lifestyle |              |                |
|--------------------------|--------------------------------------------------------|--------------|----------------|
|                          | Multivariate Analysis                                  |              |                |
|                          | OR                                                     | 95% CI       | <i>p</i> Value |
| <b>Gender</b>            |                                                        |              |                |
| Female                   | -1-                                                    |              |                |
| Male                     | 0.567                                                  | 0.271–1.184  | 0.131          |
| Others                   | 1.752                                                  | 0.221–13.920 | 0.596          |
| <b>Age range (years)</b> |                                                        |              |                |
| 22–40                    | -1-                                                    |              |                |
| 41–60                    | 1.604                                                  | 0.877–2.934  | 0.125          |
| 61–84                    | 3.094                                                  | 1.378–6.946  | <b>0.006</b>   |
| <b>Regularly cooking</b> |                                                        |              |                |
| Yes                      | -1-                                                    |              |                |
| No                       | 0.584                                                  | 0.225–1.516  | 0.269          |

Table 2. Cont.

|                                                       | Logistic Regression for High Adherence to MD Lifestyle |             |                |
|-------------------------------------------------------|--------------------------------------------------------|-------------|----------------|
|                                                       | Multivariate Analysis                                  |             |                |
|                                                       | OR                                                     | 95% CI      | <i>p</i> Value |
| <b>Attitudes toward healthy and sustainable diets</b> |                                                        |             |                |
| Less positive                                         | 0.555                                                  | 0.261–1.182 | 0.127          |
| Medium                                                | -1-                                                    |             |                |
| Positive                                              | 0.685                                                  | 0.337–1.39  | 0.294          |
| <b>Healthy and sustainable cooking self-efficacy</b>  |                                                        |             |                |
| Low                                                   | -1-                                                    |             |                |
| Medium                                                | 1.461                                                  | 0.709–3.01  | 0.304          |
| High                                                  | 1.065                                                  | 0.462–2.453 | 0.882          |
| <b>Healthy and sustainable dietary habits</b>         |                                                        |             |                |
| Less                                                  | 0.26                                                   | 0.107–0.629 | <b>0.003</b>   |
| Moderate                                              | 0.465                                                  | 0.244–0.888 | <b>0.02</b>    |
| High                                                  | -1-                                                    |             |                |

OR = Odds ratio; 95% CI = 95% confidence interval; MD = Mediterranean Diet; “-1-” indicates the reference category (baseline) in the regression analysis. The variable “country of birth” was excluded due to insufficient sample size in the “other” category within the highest tertile. Variables with a *p*-value < 0.05 in the univariate analysis, along with age, were included in the multivariate analysis. Values in bold indicate statistically significant results (*p* < 0.005).

Men were significantly less likely to report positive attitudes toward healthy and sustainable diets (OR = 0.249; 95% CI: 0.129–0.480; *p* < 0.001) as were participants aged 61–84 years compared to those aged 22–40 years (OR = 0.35; 95% CI: 0.166–0.739; *p* = 0.006). Not cooking regularly (OR = 0.071; 95% CI: 0.031–0.166; *p* < 0.001) and living with children (OR = 2.228; 95% CI: 1.246–3.986; *p* = 0.007) were also significant predictors. Participants with a university degree were less likely to have positive attitudes compared to those with advanced degrees (OR = 0.522; 95% CI: 0.298–0.914; *p* = 0.023). Greater cooking self-efficacy was strongly associated with positive attitudes, with participants in the second (OR = 12.633; 95% CI: 5.340–29.888; *p* < 0.001) and third tertiles (OR = 56.948; 95% CI: 22.003–147.390; *p* < 0.001) showing significantly higher likelihoods compared to the first tertile. In addition, high adherence to the MD lifestyle was strongly associated with positive attitudes (OR = 2.378; 95% CI: 1.237–4.57; *p* = 0.009), and less healthy and sustainable dietary habits were negatively associated with positive attitudes (OR = 0.078; 95% CI: 0.036–0.167; *p* < 0.001) (see Supplementary Material Table S7 for univariate model). In the multivariate analysis, not cooking regularly (OR = 0.31; 95% CI: 0.111–0.868; *p* = 0.026), medium and high cooking self-efficacy (medium: OR = 7.879; 95% CI: 3.116–19.922; *p* < 0.001; high: OR = 27.328; 95% CI: 9.624–77.595; *p* < 0.001), and less healthy and sustainable dietary habits (OR = 0.352; 95% CI: 0.131–0.946; *p* = 0.039) remained significant (Table 3).

**Table 3.** Odds ratios for positive attitudes toward healthy and sustainable diets from Spanish adults, estimated using multinomial logistic regression in multivariate analysis.

|               | Logistic Regression for Positive Attitudes Toward Healthy and Sustainable Diets |        |                |
|---------------|---------------------------------------------------------------------------------|--------|----------------|
|               | Multivariate Analysis                                                           |        |                |
|               | OR                                                                              | 95% CI | <i>p</i> Value |
| <b>Gender</b> |                                                                                 |        |                |
| Female        | -1-                                                                             |        |                |

Table 3. Cont.

|                                                                                  | Logistic Regression for Positive Attitudes Toward Healthy and Sustainable Diets |               |                  |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------|------------------|
|                                                                                  | Multivariate Analysis                                                           |               |                  |
|                                                                                  | OR                                                                              | 95% CI        | <i>p</i> Value   |
| Male                                                                             | 0.512                                                                           | 0.220–1.191   | 0.120            |
| Others                                                                           | 7.142                                                                           | 0.413–123.505 | 0.176            |
| <b>Age range (years)</b>                                                         |                                                                                 |               |                  |
| 22–40                                                                            | -1-                                                                             |               |                  |
| 41–60                                                                            | 0.865                                                                           | 0.413–1.809   | 0.699            |
| 61–84                                                                            | 0.755                                                                           | 0.263–2.163   | 0.600            |
| <b>Education level</b>                                                           |                                                                                 |               |                  |
| Primary, secondary studies, or vocational training                               | 1.862                                                                           | 0.671–5.169   | 0.233            |
| University degree                                                                | 0.504                                                                           | 0.241–1.051   | 0.068            |
| Master’s degrees, equivalent professional training (e.g., MIR, FIR, EIR), or PhD | -1-                                                                             |               |                  |
| <b>Household members &lt; 18 years</b>                                           |                                                                                 |               |                  |
| No                                                                               | -1-                                                                             |               |                  |
| Yes                                                                              | 1.769                                                                           | 0.827–3.785   | 0.142            |
| <b>Regularly cooking</b>                                                         |                                                                                 |               |                  |
| Yes                                                                              | -1-                                                                             |               |                  |
| No                                                                               | 0.31                                                                            | 0.111–0.868   | <b>0.026</b>     |
| <b>Adherence to MD lifestyle</b>                                                 |                                                                                 |               |                  |
| Low                                                                              | -1-                                                                             |               |                  |
| Medium                                                                           | 1.082                                                                           | 0.501–2.336   | 0.841            |
| High                                                                             | 1.231                                                                           | 0.522–2.907   | 0.635            |
| <b>Healthy and sustainable cooking self-efficacy</b>                             |                                                                                 |               |                  |
| Low                                                                              | -1-                                                                             |               |                  |
| Medium                                                                           | 7.879                                                                           | 3.116–19.922  | <b>&lt;0.001</b> |
| High                                                                             | 27.328                                                                          | 9.624–77.595  | <b>&lt;0.001</b> |
| <b>Healthy and sustainable dietary habits</b>                                    |                                                                                 |               |                  |
| Less                                                                             | 0.352                                                                           | 0.131–0.946   | <b>0.039</b>     |
| Moderate                                                                         | 1.335                                                                           | 0.599–2.978   | 0.48             |
| High                                                                             | -1-                                                                             |               |                  |

OR = Odds ratio; 95% CI = 95% confidence interval; MD = Mediterranean Diet; “-1-” indicates the reference category (baseline) in the regression analysis. Variables with a *p*-value < 0.05 in the univariate analysis, along with age, were included in the multivariate analysis. Values in bold indicate statistically significant results (*p* < 0.005).

Greater cooking self-efficacy was less common among men (OR = 0.304; 95% CI: 0.163–0.568; *p* < 0.001) and among participants aged 61–84 years compared to those aged 22–40 years (OR = 0.289; 95% CI: 0.133–0.628; *p* = 0.002). Not cooking regularly was strongly associated with lower likelihood of cooking self-efficacy (OR = 0.057; 95% CI: 0.020–0.164; *p* < 0.001). High adherence to the MD lifestyle was positively associated with greater cooking self-efficacy (OR = 2.08; 95% CI: 1.101–3.931; *p* = 0.024). Similarly, positive attitudes were strongly associated with greater cooking self-efficacy (OR = 13.313; 95% CI: 5.69–31.148; *p* < 0.001), while less positive attitudes showed an inverse association (OR = 0.234; 95% CI: 0.111–0.494; *p* < 0.001). Participants with moderate and less healthy and sustainable dietary habits were less likely to report greater cooking self-efficacy (moderate: OR = 0.264; 95% CI: 0.142–0.491; *p* < 0.001; less: OR = 0.04; 95% CI: 0.016–0.098; *p* < 0.001), than those with healthier and more sustainable dietary habits. Living with children was also a significant predictor (OR = 2.424; 95% CI: 1.353–4.344; *p* = 0.003) (see

Supplementary Material Table S8 for univariate model). In the multivariate analysis, not cooking regularly (OR = 0.185; 95% CI: 0.059–0.576;  $p = 0.004$ ), age 61–84 years (OR = 0.295; 95% CI: 0.119–0.730;  $p = 0.008$ ), positive attitudes (OR = 13.401; 95% CI: 5.397–33.276;  $p < 0.001$ ), and moderate and less healthy and sustainable dietary habits (moderate: OR = 0.314; 95% CI: 0.150–0.659;  $p = 0.002$ ; less: OR = 0.07; 95% CI: 0.026–0.188;  $p < 0.001$ ) remained significant predictors (Table 4).

**Table 4.** Odds ratios for greater cooking self-efficacy from Spanish adults, estimated using multinomial logistic regression in multivariate analysis.

|                                                       | Logistic Regression for Greater Cooking Self-Efficacy |              |                  |
|-------------------------------------------------------|-------------------------------------------------------|--------------|------------------|
|                                                       | Multivariate Analysis                                 |              |                  |
|                                                       | OR                                                    | 95% CI       | <i>p</i> Value   |
| <b>Gender</b>                                         |                                                       |              |                  |
| Female                                                | -1-                                                   |              |                  |
| Male                                                  | 0.874                                                 | 0.390–1.958  | 0.743            |
| Others                                                | 0.279                                                 | 0.016–4.942  | 0.384            |
| <b>Age range (years)</b>                              |                                                       |              |                  |
| 22–40                                                 | -1-                                                   |              |                  |
| 41–60                                                 | 0.975                                                 | 0.486–1.956  | 0.944            |
| 61–84                                                 | 0.329                                                 | 0.119–0.908  | <b>0.032</b>     |
| <b>Household members &lt; 18 years</b>                |                                                       |              |                  |
| No                                                    | -1-                                                   |              |                  |
| Yes                                                   | 1.807                                                 | 0.855–3.82   | 0.121            |
| <b>Regularly cooking</b>                              |                                                       |              |                  |
| Yes                                                   | -1-                                                   |              |                  |
| No                                                    | 0.273                                                 | 0.077–0.963  | <b>0.044</b>     |
| <b>Adherence to MD lifestyle</b>                      |                                                       |              |                  |
| Low                                                   | -1-                                                   |              |                  |
| Medium                                                | 1.337                                                 | 0.629–2.843  | 0.45             |
| High                                                  | 1.181                                                 | 0.508–2.745  | 0.7              |
| <b>Attitudes toward healthy and sustainable diets</b> |                                                       |              |                  |
| Less positive                                         | 0.536                                                 | 0.229–1.257  | 0.152            |
| Medium                                                | -1-                                                   |              |                  |
| Positive                                              | 13.401                                                | 5.397–33.276 | <b>&lt;0.001</b> |
| <b>Healthy and sustainable dietary habits</b>         |                                                       |              |                  |
| Less                                                  | 0.102                                                 | 0.034–0.301  | <b>&lt;0.001</b> |
| Moderate                                              | 0.314                                                 | 0.150–0.659  | <b>0.002</b>     |
| High                                                  | -1-                                                   |              |                  |

OR = Odds ratio; 95% CI = 95% confidence interval; MD = Mediterranean Diet; “-1-” indicates the reference category (baseline) in the regression analysis. Variables with a  $p$ -value  $< 0.05$  in the univariate analysis, along with age, were included in the multivariate analysis. Values in bold indicate statistically significant results ( $p < 0.005$ ).

Healthier and more sustainable dietary habits were less likely among men (OR = 0.166; 95% CI: 0.085–0.322;  $p < 0.001$ ), and not cooking regularly was strongly associated with lower levels of these habits (OR = 0.036; 95% CI: 0.013–0.095;  $p < 0.001$ ). The three remaining dependent variables were also significantly associated with dietary habits, ex-

cept for positive attitudes. Specifically, medium adherence to the MD lifestyle (OR = 2.5; 95% CI: 1.355–4.613;  $p = 0.003$ ) and high adherence to the MD lifestyle (OR = 6.264; 95% CI: 2.985–13.145;  $p < 0.001$ ) were positively associated with healthier dietary habits. Similarly, less positive attitudes toward healthy and sustainable diets were negatively associated with these habits (OR = 0.169; 95% CI: 0.086–0.333;  $p < 0.001$ ), while higher cooking self-efficacy showed very robust associations, both for medium (OR = 4.609; 95% CI: 2.385–8.908;  $p < 0.001$ ) and high levels (OR = 25.097; 95% CI: 10.154–62.030;  $p < 0.001$ ) (see Supplementary Material Table S9 for univariate model). In the multivariate analysis, in addition to male gender (OR = 0.267; 95% CI: 0.128–0.558;  $p < 0.001$ ) and not cooking regularly (OR = 0.042; 95% CI: 0.015–0.116;  $p < 0.001$ ), high adherence to the MD lifestyle (OR = 3.836; 95% CI: 1.579–9.322;  $p = 0.003$ ) and high cooking self-efficacy (OR = 9.220; 95% CI: 3.131–27.157;  $p < 0.001$ ) also remained significant predictors of healthier and more sustainable dietary habits (Table 5).

**Table 5.** Odds ratios for high healthy and sustainable dietary habits from Spanish adults, estimated using multinomial logistic regression in multivariate analysis.

|                                                       | Logistic Regression for High Healthy and Sustainable Dietary Habits |              |                  |
|-------------------------------------------------------|---------------------------------------------------------------------|--------------|------------------|
|                                                       | Multivariate Analysis                                               |              |                  |
|                                                       | OR                                                                  | 95% CI       | <i>p</i> Value   |
| <b>Gender</b>                                         |                                                                     |              |                  |
| Female                                                | -1-                                                                 |              |                  |
| Male                                                  | 0.353                                                               | 0.160–0.779  | <b>0.01</b>      |
| Others                                                | 0.107                                                               | 0.008–1.497  | 0.097            |
| <b>Age range (years)</b>                              |                                                                     |              |                  |
| 22–40                                                 | -1-                                                                 |              |                  |
| 41–60                                                 | 1.492                                                               | 0.725–3.07   | 0.277            |
| 61–84                                                 | 2.358                                                               | 0.906–6.138  | 0.079            |
| <b>Regularly cooking</b>                              |                                                                     |              |                  |
| Yes                                                   | -1-                                                                 |              |                  |
| No                                                    | 0.114                                                               | 0.039–0.335  | <b>&lt;0.001</b> |
| <b>Adherence to MD lifestyle</b>                      |                                                                     |              |                  |
| Low                                                   | -1-                                                                 |              |                  |
| Medium                                                | 2.069                                                               | 0.974–4.392  | 0.058            |
| High                                                  | 3.836                                                               | 1.579–9.322  | <b>0.003</b>     |
| <b>Attitudes toward healthy and sustainable diets</b> |                                                                     |              |                  |
| Less positive                                         | 0.479                                                               | 0.212–1.078  | 0.075            |
| Medium                                                | -1-                                                                 |              |                  |
| Positive                                              | 1.246                                                               | 0.492–3.152  | 0.643            |
| <b>Healthy and sustainable cooking self-efficacy</b>  |                                                                     |              |                  |
| Low                                                   | -1-                                                                 |              |                  |
| Medium                                                | 2.179                                                               | 0.99–4.794   | 0.053            |
| High                                                  | 9.22                                                                | 3.131–27.157 | <b>&lt;0.001</b> |

OR = Odds ratio; 95% CI = 95% confidence interval; MD = Mediterranean Diet; “-1-” indicates the reference category (baseline) in the regression analysis. Variables with a  $p$ -value  $< 0.05$  in the univariate analysis, along with age, were included in the multivariate analysis. Values in bold indicate statistically significant results ( $p < 0.005$ ).

## 4. Discussion

This study highlights key behavioral and sociodemographic factors associated with adherence to the MD lifestyle among Spanish adults. Overall, greater adherence was linked to older age and healthier, more sustainable dietary habits, while positive attitudes and higher cooking self-efficacy were associated with regular cooking. Notably, women and individuals living with children reported healthier habits and greater confidence in cooking. Despite limited knowledge about sustainable diets, over half of participants recognized the MD as a sustainable model. These findings underscore the interplay between knowledge, attitudes, and cooking-related behaviors in shaping sustainable dietary patterns. A summary of the main associations is presented in Figure 4.

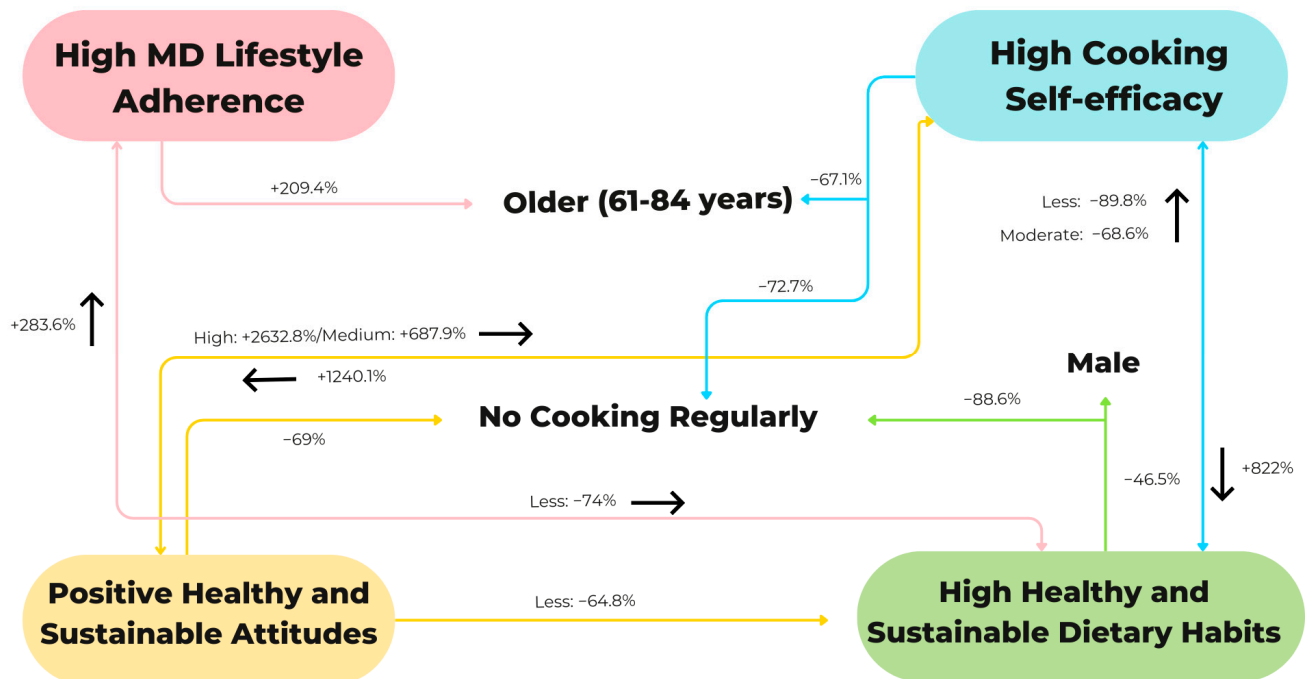


**Figure 4.** Summary of significant associations identified in the multivariable multinomial logistic regression analysis. Directed arrows indicate statistically significant associations ( $p < 0.05$ ), with the direction of the arrow representing the direction of the relationship (from predictor to outcome). The percentage above each arrow reflects the strength of the association, derived from the odds ratio. A “+” symbol indicates a positive association, while a “−” symbol indicates a negative association. MD = Mediterranean Diet. Less refers to the first tertile (T1), Medium or Moderate to the second tertile (T2), and High to the third tertile (T3). Colors are used to differentiate dependent variables.

#### 4.1. Adherence to the MD, Healthy and Sustainable Dietary Attitudes, Habits, and Cooking Self-Efficacy

An overarching finding of this study is the strong interrelationship observed between the dependent variables. Our findings suggest that individuals with higher adherence to the MD lifestyle also tend to report healthier and more sustainable dietary habits, such as eating homemade food or cooking for oneself, suggesting a possible clustering of pro-health and pro-sustainability behaviors. This association is consistent with the findings from the validation study of the SHED index in Portugal [46], underscoring the importance of promoting healthy and sustainable eating behaviors.

Furthermore, in the multivariable regression model, we found a significant association between positive attitudes toward healthy and sustainable diets, dietary habits, and greater cooking self-efficacy. These findings are supported by prior research demonstrating that individuals with greater cooking self-efficacy are more likely to prepare meals at home,

use fresh ingredients, consume more fruits and vegetables, and rely less on convenience foods [53], ultimately fostering healthier dietary attitudes. Consistently, a large proportion of our participants reported enjoying trying new recipes (77.1%) and feeling confident when cooking with fresh ingredients (91%), suggesting that culinary self-efficacy also plays an important role in supporting positive dietary behaviors.

However, our data also reveal a decline in self-efficacy as the complexity of cooking tasks increases. There was a 28.5% decrease in the proportion of participants who felt capable of following a simple recipe to those who felt capable of preparing meat dishes (deboning chicken or making meatballs or hamburgers). It suggests the need for tailored strategies that build confidence across varying levels of culinary challenge. This highlights the importance of educational approaches that not only teach cooking skills but also empower individuals to consistently integrate these practices into their daily routines, even when facing more demanding culinary tasks.

While increased cooking self-efficacy is positively associated with healthy and sustainable dietary attitudes and habits, it is important to recognize that self-efficacy does not operate in isolation. To achieve greater adherence to a healthy and sustainable diet, it is not enough to improve specific intakes, and broader structural factors must also be considered. For instance, a study conducted among overweight and obese adults found that although a culinary program significantly improved cooking self-efficacy and MD adherence, it did not lead to substantial changes in cooking attitudes or long-term behaviors [54]. This suggests that skill development alone may be insufficient to drive lasting behavioral change, and that broader psychosocial and motivational factors must also be addressed.

In this regard, our data indicate that neither confidence nor technical ability, on their own, consistently translate into improved dietary habits or attitudes, as more than half of our participants highlighted a need for practical tools to support healthy and sustainable cooking and shopping habits. In this sense, a growing body of literature emphasizes the effectiveness of multilayered intervention strategies, integrating practical tips with experiential learning, structured meal planning, environmental supports, and socioemotional reinforcement, as a more robust and sustainable approach to enhancing cooking self-efficacy and promoting enduring behavior change [21,55,56]. Specifically related to the findings of our study, public health interventions should incorporate strategies to develop and sustain cooking self-efficacy across varying levels of complexity. These strategies may include interactive culinary workshops, meal-planning resources, and motivational components, not only to teach cooking skills, but also to foster the confidence and empowerment necessary to integrate these practices into daily life [19]. Moreover, interventions targeting improvements in cooking self-efficacy, especially those incorporating hands-on practice and motivational support, have been found to be more effective in enhancing healthier diets than those focused solely on technical skill development [57,58]. Culinary education programs that have been shown to improve dietary habits and reduce food-related costs may thus represent a key avenue for promoting sustainable dietary patterns [59].

#### *4.2. Gender, Age, and Regular Cooking*

Consistent with previous studies [60–62], our results indicate that older adults exhibit higher adherence to the MD lifestyle. This trend may be attributed to a combination of factors, including a cultural familiarity and a stronger connection to traditional dietary patterns among older individuals [61,62]. For example, a Portuguese cross-sectional study [60] found that older participants were more likely to have greater MD adherence than younger ones, even after adjusting for socioeconomic status. Patino-Alonso et al. [61] reported that older adults were more likely to align with MD principles, possibly due to a lifelong exposure to Mediterranean culinary customs. Moreover, baseline data from the PREDIMED

trial confirmed that older age was positively associated with MD adherence, suggesting that these demographic characteristics play a pivotal role in shaping dietary behaviors [63]. In this regard, the MEDLIFE index developed by Sotos-Prieto et al. [38] offers a comprehensive tool for assessing overall adherence to the Mediterranean lifestyle, encompassing not only dietary components but also physical activity, social habits, and rest, thus supporting the multidimensional nature of MD adherence captured in our results.

However, our findings revealed an inverse association between age and cooking self-efficacy, with older participants reporting lower levels of confidence in their cooking abilities. These findings are consistent with those reported by García-González et al. in a cross-sectional study conducted in Spain, where a significantly higher proportion of individuals under the age of 50 self-reported being “able to cook” compared to those over 50 years old [64], and suggest that interventions aimed at improving cooking self-efficacy may need to be tailored to older adults.

Moreover, in our study, gender appears to play a significant role in shaping healthy and sustainable dietary habits, as being male was significantly associated with a lower likelihood of exhibiting such habits. In this context, a recent population-based study conducted in Sweden by Bärebring et al. [65] found that women were more likely than men to avoid foods perceived as unhealthy, such as red meat, and also reported higher levels of diet-related anxiety, indicating a heightened concern for healthful eating. Similarly, Wardle et al. [66] demonstrated that women tend to make healthier food choices than men, largely driven by stronger health beliefs and greater nutritional awareness. Consistent with the concept of the “meat gender gap” described by Fantechi et al. [67], our findings suggest that gender-specific norms and perceptions may influence dietary behaviors, highlighting the importance of developing targeted, gender-sensitive strategies to promote sustainable diets. These findings suggest that men may require more targeted and tailored strategies to promote healthier and more sustainable dietary practices, potentially addressing motivational and informational gaps.

Beyond sociodemographic determinants, practical and contextual factors also significantly influence the dependent variables. Our results show that individuals who cook regularly are significantly more likely to have positive healthy and sustainable attitudes and dietary habits and greater cooking self-efficacy, a finding corroborated by Wolfson JA and Bleich SN [53]. This association reinforces the importance of cooking as a central behavior in promoting a healthy and sustainable diet, aligning with the findings of Mengi et al. [63], who reported that cooking and food preparation skills are positively associated with healthy attitudes and habits. These findings underscore the value of culinary literacy and home cooking as practical tools to foster sustainable and health-promoting eating habits, particularly in modern societies where convenience-driven food choices increasingly dominate.

#### *4.3. Sustainable and Healthy MD Knowledge*

The findings of this study reveal a complex landscape regarding participants’ understanding and perception of sustainability in the context of diet. Two distinct but interrelated dimensions emerge: a general lack of knowledge about what constitutes a sustainable diet and limited recognition of the MD as a sustainable model.

First, the data show that a substantial proportion of participants (57.9%) did not align with the scientific consensus on sustainable diets, reflecting either uncertainty or partial misconception about their broader meaning. This suggests a limited understanding of the multidimensional nature of sustainability, which encompasses not only health but also environmental, sociocultural, and economic dimensions. This finding is consistent with previous studies in Spain and other European countries, where sustainability is often

reduced to vague notions or conflated with health alone. For instance, a 2020 Spanish study found that environmental impact was the least recognized attribute of a sustainable diet, and misconceptions about the sustainability of meat, fish, and dairy were widespread [26]. Similar patterns have been observed in Poland, where only 6% of urban consumers associated sustainable consumption with nutrition [28], and in Italy, where only half of respondents recognized the MD as a sustainable model [27]. This result underscores the need to expand the public's understanding of sustainability beyond nutrition and health to include environmental, social, and economic dimensions.

Second, even among those who demonstrated some awareness of sustainability, the specific association between the MD and sustainability was not universally acknowledged. Although 58.1% of participants agreed or strongly agreed that the MD is a sustainable dietary model, this leaves a significant portion of the population unaware of the alignment between this traditional pattern and sustainability principles. This gap is particularly relevant given the MD's potential as a culturally embedded, accessible, and evidence-based framework for promoting sustainable eating. The disconnect between familiarity with the MD and recognition of its sustainability benefits represents a missed opportunity for public health messaging and education. It also suggests that the sustainability narrative surrounding the MD has not been effectively communicated or internalized by the public.

The concept of sustainability itself may be perceived as complex, politicized, or disconnected from everyday life. Moreover, consumers often face conflicting messages, limited access to sustainable options, and a lack of practical tools to translate sustainability intentions into action. Without addressing these barriers, through clearer communication, supportive environments, and policy-level interventions, educational efforts alone may be insufficient to drive meaningful change.

#### *4.4. Implications for Public Health and Future Research*

This study yields relevant implications for public health policy and nutrition-related sustainability interventions. Promoting adherence to the MD and encouraging healthier and more sustainable dietary habits in the Spanish adult population may be achieved through strategies that foster regular home cooking, enhance cooking self-efficacy, and cultivate positive attitudes toward sustainable eating.

The formation of these attitudes does not stem solely from increased awareness or informational campaigns. Evidence suggests that merely communicating the health or environmental benefits of a diet are often insufficient to change behavior [68]. Instead, more effective approaches involve aligning messages with the real drivers of food choice, such as taste, pleasure, cultural familiarity, convenience, and social context [69]. Framing sustainable and healthy eating within these motivational dimensions may enhance emotional engagement and perceived self-relevance, ultimately strengthening behavioral intention and adherence [70]. For example, promoting the MD not only as a health-promoting pattern but as a pleasurable, culturally rooted, and easy-to-implement way of eating could yield more impactful and lasting changes in dietary behavior.

In this regard, interventions in formal education settings represent a valuable opportunity for early prevention. Introducing culinary education programs in schools, particularly with a gender-sensitive approach, could help address disparities in dietary adherence, as men were found to be less engaged in healthy and sustainable eating practices. Likewise, integrating formal education about the MD into school curricula may contribute to early development of healthy eating habits rooted in sustainability principles.

Beyond the educational sphere, broader policy measures are also essential. Incorporating plant-based food subsidies into national dietary guidelines can promote affordable, sustainable diets and support health and environmental goals. A broader strategy should

integrate sustainability into food recommendations, complemented by measures such as incentives for sustainable purchases and taxes on harmful foods, although their success may depend on cultural and socioeconomic factors [71,72].

Moreover, sustainability labeling on food products also emerges as a potentially effective measure for guiding consumer behavior. Behavioral nudges such as eco-labels can facilitate more sustainable choices without limiting freedom of selection [73]. Public health campaigns should emphasize the multidimensionality of sustainable diets, linking nutritional quality, environmental impact, and social equity, to support coherent and inclusive dietary transformations.

The effectiveness of such multilevel approaches is supported by existing examples. Italy's national policies promoting the MD have demonstrated the effectiveness of government-led initiatives in fostering adherence to traditional, plant-based eating patterns [74]. Similarly, the European Union's 'Farm to Fork' Strategy [75], which emphasizes sustainable food systems and the reduction in the environmental impact of agriculture, aligns closely with the recommendations of this study to enhance culinary skills and promote sustainable dietary habits.

Building on these findings, future research should focus on several key areas. Further exploration of the impact of culinary training and educational interventions on adherence to sustainable and healthy diets is warranted. Additionally, research into the influence of socioeconomic and cultural factors on dietary behaviors could help tailor interventions to specific populations, ensuring their effectiveness. This would enable the development of targeted strategies that address barriers faced by vulnerable or underrepresented groups, such as men, older adults, or low-income households. Long-term cohort studies are needed to assess both the health and sustainability outcomes of dietary patterns, as well as the effectiveness of interventions over time, and to help overcome the limitations of cross-sectional designs.

In particular, future research should examine the effectiveness of behavioral nudges, such as sustainability labels or incentives for purchasing locally sourced ingredients, to encourage healthier and more sustainable dietary choices. Investigating how these strategies interact with culinary self-efficacy and attitudes could inform the design of more effective public health campaigns. By addressing these research gaps, future studies can build on the findings of this work, contributing to the development of evidence-based interventions that promote healthier and more sustainable dietary behaviors at both individual and population levels.

#### 4.5. Limitations

While the sampling method ensured broad reach, limitations include potential underrepresentation of individuals without internet access or those less likely to engage with online platforms. The study sample was predominantly composed of young adult women with a high educational level, most of whom resided in urban areas. Therefore, the sample is not representative of the broader Spanish population. This lack of representativeness limits the generalizability of the findings, as the observed associations, particularly those related to gender, education level, and urban living, may not accurately reflect the behaviors or attitudes of other demographic groups, such as individuals with lower educational attainment, men, or those living in rural areas. Future research should address this limitation by employing more diverse sampling strategies, including offline surveys or longitudinal mixed-method studies that incorporate rural populations and deliberately aim to over-represent rural and male populations, in order to ensure a more inclusive representation of the general population. Modality differences should be considered when comparing our findings to those obtained through in-person designs. The analysis of knowledge-related

variables may be subjective, influenced by personal beliefs, cultural factors, or individual interpretations, and the chosen categorizations, while based on scientific consensus, may not fully capture answer accuracy. The cross-sectional design precludes establishing causal relationships, and self-reported data may introduce social desirability bias. The results may not be transferable to other cultural situations, where dietary habits and lifestyle factors may differ. Further studies are needed to investigate the influence of evolving gender roles, socioeconomic factors, and cultural contexts on cooking habits and dietary adherence.

## 5. Conclusions

This study emphasizes how attitudes, culinary abilities, and sociodemographic characteristics affect Spanish people's adherence to the MD lifestyle. Only 58.1% of respondents identified the MD as a sustainable model, indicating that knowledge gaps about food sustainability still exist. Higher adherence was observed among older individuals and those with healthier and more sustainable dietary habits. In contrast, greater cooking self-efficacy was positively associated with younger individuals, those who cook regularly, and those displaying healthier and more sustainable dietary habits. Positive attitudes toward sustainable and healthy diets were also linked to regular cooking, greater cooking self-efficacy, and healthier and more sustainable dietary behaviors. Additionally, having healthier and more sustainable dietary habits was positively associated with being female and cooking regularly.

These findings underscore the importance of educational strategies that combine environmental and health aspects while promoting culinary abilities, particularly among urban populations and men. Public policies that support sustainable food labeling, home cooking, and culinary education could help accelerate the adoption of the MD, ultimately improving both environmental sustainability and public health. Given the predominantly highly educated sample, future research should explore the role of educational level in shaping knowledge, adherence to the MD lifestyle, cooking self-efficacy, and attitudes and habits in terms of sustainable and healthy diets. To bridge the gap between knowledge and behavior, future studies should also address representativeness limitations and assess the effectiveness of behavioral strategies.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su17198580/s1>, File S1: Questionnaire; Table S1: Punctuation criteria; Figure S1. Knowledge about sustainable diets and perception of the MD as a sustainable model among Spanish adults; Figure S2. Percentage of Spanish adults (n = 380) reporting healthy and sustainable dietary habits; Table S2: Participants' responses by tertiles of adherence to the MD lifestyle (MEDLIFE); Table S3: Participants' responses by tertiles of attitudes toward healthy and sustainable diets; Table S4: Participants' responses by tertiles of healthy and sustainable cooking self-efficacy. Table S5: Participants' responses by tertiles of healthy and sustainable dietary habits; Table S6: Odds ratios for high adherence to MD lifestyle from Spanish adults, estimated using multinomial logistic regression in univariate analysis; Table S7: Odds ratios for positive attitudes toward healthy and sustainable diets from Spanish adults, estimated using multinomial logistic regression in univariate analysis; Table S8: Odds ratios for greater cooking self-efficacy from Spanish adults, estimated using multinomial logistic regression in univariate analysis; Table S9: Odds ratios for high healthy and sustainable dietary habits from Spanish adults, estimated using multinomial logistic regression in univariate analysis.

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## Abbreviations

The following abbreviations are used in this manuscript:

|      |                                   |
|------|-----------------------------------|
| MD   | Mediterranean Diet                |
| FAO  | Food and Agriculture Organization |
| SDGs | Sustainable Development Goals     |

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